

CLAIMS

What is claimed is:

1. A printed-circuit (PC) thermopile comprising:
 - a substrate having a first surface and a second surface, and having a first thermal portion and a second thermal portion;
 - a plurality of first traces, wherein each of said first traces is formed of a first metal and extends between said first thermal portion and said second thermal portion upon said first surface;
 - a plurality of second traces, wherein each of said second traces is formed of a second metal and extends between said first thermal portion and said second thermal portion upon said second surface;
 - a plurality of first junctions, wherein each of said first junctions couples one of said first traces with one of said second traces in said first thermal portion; and
 - a plurality of second junctions, wherein each of said second junctions couples one of said first traces with one of said second traces in said second thermal portion, and wherein each of said second junctions is in series with one of said first junctions.
2. A PC thermopile as claimed in claim 1 wherein, when said PC thermopile is in operation:
 - said first thermal portion is maintained at a first temperature; and
 - said second thermal portion is maintained at a second temperature different from said first temperature.
3. A PC thermopile as claimed in claim 2 wherein:
 - said first thermal portion is surrounded by a first medium at said first temperature; and

said second thermal portion is surrounded by a second medium at said second temperature.

4. A PC thermopile as claimed in claim 2 wherein:
each of said first junctions is maintained at substantially said first temperature; and
each of said second junctions is maintained at substantially said second temperature.

5. A PC thermopile as claimed in claim 1 additionally comprising a plurality of third traces, wherein each of said third traces:
passes through said substrate from said first side to said second side;
couples one of said first traces with one of said second traces; and
forms one of said first and second junctions upon one of said first and second sides.

6. A PC thermopile as claimed in claim 5 wherein:
said third metal is substantially identical to said first metal; and
said one junction is formed upon said second side.

7. A PC thermopile as claimed in claim 1 wherein:
said first metal is copper; and
said second metal is constantan.

8. A PC thermopile as claimed in claim 1 additionally comprising a plurality of conductive pins coupling one of said first traces with one of said second traces to form one of said first and second junctions.

9. A PC thermopile as claimed in claim 8 wherein said conductive pin is formed of one of said first and second metals.

10. A PC thermopile as claimed in claim 8 wherein each of said conductive pins extends into a medium surrounding said one junction.

11. A thermoelectric generation system configured to provide a predetermined voltage at a predetermined current, said system comprising:

- a plurality of printed-circuit (PC) thermopiles; and
- a backplane coupled to each of said PC thermopiles and configured to electrically connect said PC thermopile to provide said predetermine voltage at said predetermined current.

12. A thermoelectric generation system as claimed in claim 11 wherein each of said PC thermopiles comprises:

- a substrate having a first surface and a second surface;
- a plurality of first traces, wherein each of said first traces is formed of a first metal upon said first surface;
- a plurality of second traces, wherein each of said second traces is formed of a second metal upon said second surface;
- a plurality of first junctions, wherein each of said first junctions couples one of said first traces with one of said second traces; and
- a plurality of second junctions, wherein each of said second junctions couples one of said first traces with one of said second traces, and wherein each of said second junctions is coupled in series with one of said first junctions.

13. A thermoelectric generation system as claimed in claim 12 wherein, when said system is in operation:

- each of said first junctions is maintained at substantially a first temperature; and

each of said second junctions is maintained at substantially a second temperature different from said first temperature.

14. A thermoelectric generation system as claimed in claim 12 wherein:

said first metal is copper; and
said second metal is constantan.

15. A thermoelectric generation system as claimed in claim 12 wherein each of said PC thermopiles additionally comprises a plurality of third traces, wherein each of said third traces couples one of said first traces with one of said second traces to form one of said first and second junctions.

16. A thermoelectric generation system as claimed in claim 15 wherein each of said third traces is formed of said first metal.

17. A thermoelectric generation system as claimed in claim 12 wherein each of said PC thermopiles additionally comprises a plurality of conductive pins, wherein each of said conductive pins couples one of said first traces with one of said second traces to form one of said first and second junctions.

18. A thermoelectric generation system as claimed in claim 11 wherein:

said predetermined voltage is a first predetermined voltage;
said predetermined current is a first predetermined current;
each of said PC thermopiles is configured to provide a second predetermined voltage at a second predetermined current;

said backplane is configured to electrically connect said plurality of PC thermopiles so that said second predetermined voltage from each of said PC thermopiles together produce said first predetermined voltage; and

said backplane is configured to electrically connect said plurality of PC thermopiles so that said second predetermined current from each of said PC thermopiles together produce said first predetermined current.

19. A thermoelectric generation system as claimed in claim 18 wherein:

each of said PC thermopiles comprises a plurality of thermocouples;

each of said thermocouples is configured to provide a third predetermined voltage at a third predetermined current;

each of said PC thermopiles is configured to electrically connect said plurality of thermocouples so that said third predetermined voltage from each of said thermocouples together produce said second predetermined voltage; and

each of said PC thermopiles is configured to electrically connect said plurality of thermocouples so that said third predetermined current from each of said thermocouples together produce said second predetermined current.

20. A thermoelectric generation system comprising:

a plurality of printed-circuit (PC) thermopiles, wherein each of said PC thermopiles comprises:

a substrate having a first surface and a second surface;

and

a plurality of thermocouples, wherein each of said thermocouples comprises:

a first trace formed of a first metal upon said first surface of said substrate;

a second trace formed of a second metal upon said second surface of said substrate;

a first junction formed between said first and second traces and maintained at substantially a first predetermined temperature; and

a second junction formed between said first and second traces and maintained at substantially a second predetermined temperature different from said first predetermined temperature; and

a backplane coupled to each of said PC thermopiles, wherein:

- each of said thermocouples is configured to provide
 - substantially a predetermined thermocouple voltage at
 - substantially a predetermined thermocouple current;
- each of said PC thermopiles is configured to electrically connect said plurality of thermocouples so that said predetermined thermocouple voltage and current from each of said thermocouples together produce
 - substantially a predetermined thermopile voltage at
 - substantially a predetermined thermopile current; and
- said backplane is configured to electrically connect said plurality of PC thermopiles so that said predetermined thermopile voltage and current from each of said PC thermopiles together produce a predetermined system voltage at a predetermined system current.